(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 068 760**
B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication of patent specification: **02.10.85**

(51) Int. Cl.^{4}: **C 02 F 1/48**

(21) Application number: **82303194.3**

(22) Date of filing: **18.06.82**

(54) **Magnetic water-conditioning device.**

(30) Priority: **19.06.81 CA 380251**

(43) Date of publication of application:
05.01.83 Bulletin 83/01

(45) Publication of the grant of the patent:
02.10.85 Bulletin 85/40

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
GB-A- 878 525
GB-A-1 423 927
GB-A-2 023 116

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EP 0 068 760 B1

Description

The present invention relates to magnetic water-conditioning devices in which the water to be treated flows through a flow gap of adjustable width across which a magnetic field acts which is generated by a permanent magnet.

For a number of years, it has been known that fresh water containing various dissolved minerals such as calcium and magnesium (calcareous material) could be effectively treated to reduce mineral precipitation from the water, when it is heated, by passing the water through a strong magnetic field. It is believed that passing the fresh water containing minerals through the magnetic field beneficially affects the growth pattern or crystal structure of the mineral ions dissolved in the fresh water. Subsequently, when the water is heated (which reduces the solubility of the minerals in the water), the ions precipitate into the body of the water as discrete suspended particles, rather than build scale onto the surfaces contacting the water. The individually suspended particles tend not to plate or deposit as scale on the walls of the water conduit and hence pass through the conduit along with the water. The calcareous material, after the water containing calcareous material is treated with a magnetic conditioner, is soft in texture and does not adhere to heat exchange surfaces.

The magnetic water conditioning device has also been found useful for removing existing scale which has been previously deposited in the conduit prior to installation of the magnetic water conditioner.

Prior magnetic water treating devices known to the applicant are disclosed in the following patents:

U.S. Patent No. 2,678,729 — Spondig (May, 1954)

U.S. Patent No. 2,652,925 — Vermeiren (September, 1953)

U.S. Patent No. 2,825,464 — Mack (March, 1958)

U.S. Patent No. 2,939,830 — Green et al.

U.S. Patent No. 2,951,581 — Moriya (September, 1960)

U.S. Patent No. 3,170,871 — Moriya (February, 1963)

U.S. Patent No. 3,345,594 — Vermeiren

U.S. Patent No. 3,669,274 — Happ et al. (June 1972)

U.S. Patent No. 3,680,705 — Happ et al. (August, 1972)

U.S. Patent No. 3,923,660 — Kottmeier (December 1975)

U.S. Patent No. 4,146,479 — Brown (March, 1979)

British Patent No. 1,423,927 — Sundt (February, 1976)

The magnetic water conditioning devices disclosed in these various references have several serious shortcomings and two major shortcomings. First, the permanent magnets utilized in the devices are not effectively insulated from the water passing through the devices and consequently solid material tends to deposit on the magnets, and the magnets tend to corrode over a period of time, thereby reducing their effectiveness.

Secondly, none of the magnetic devices disclosed has any inherent capability to deal with changing water flow rates or water pressures, or to vary the force of the magnetic field in relation to the flow-rate of water through the device, without disassembling of the device and manual internal adjustment.

This latter deficiency is particularly troublesome in new installations where the quantity of water used per day by the user or the rate of water flow is not accurately known. Consequently the unit that is installed may be either oversize or undersize. In such a case, the only remedy is to replace the unit with a unit of a different size, at substantial expense.

An adjustable magnetic water conditioning solid under the trade mark AQUA-DIAL 15 is available from BSAL Kingston-upon-Thames, Surrey, England. However, the adjustability feature in that device is located internally within the device and hence the device must be disassembled in order to make any necessary adjustments. Additionally, the device does not provide a built-in Venturi effect.

Patent Specification GB—A—2 023 116 describes a magnetic water-conditioning device in which a permanent magnet providing the field across the flow gap is isolated from fluid being treated in the device by means of a thin separation membrane made of non-magnetic stainless steel.

The device in accordance with the present invention is characterized in that the permanent magnet is surrounded by a protective sleeve closed at one end by an adjusting cap and at the other by a pole piece to form a plug body in which the magnet is enclosed for protection against water flowing through the gap, the pole piece defines one side of the gap and the plug body is adjustably mounted in a housing and coupled to means which enable the position of the pole-piece in the housing to be adjusted from outside the housing to control the gap size and thereby change simultaneously the flow rate and the strength of the magnetic field.

The conditioning device optionally can be equipped internally or externally with a water filtering device.

The device is also preferably designed to provide a Venturi-type gap in the area where the magnetic field is concentrated thereby tending to keep the gap free of foreign particles.

DRAWINGS

In the drawings:

FIGURE 1 represents a side elevation partly-sectioned view of the adjustable magnetic water conditioner;

FIGURE 2 represents an end elevation partly-sectioned view of the adjustable magnetic water conditioner;

FIGURE 3 represents a side elevation partly-sectioned view of an alternative embodiment of the magnetic water conditioner;

FIGURE 4 represents an end elevation partly-sectioned view of an alternative embodiment of the magnetic water conditioner.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGURE 1, the magnetic water conditioner 1 is constructed of a hollow housing 2 having a water inlet 3 and a water outlet 4. Inlet 3 and outlet 4 are female threaded to accommodate standard size water piping. The direction of water flow through the housing 2 is indicated by the directional arrows.

Affixed to the housing 2 is a hollow cylindrical-like internal cup 5, which is held in place against the housing 2 by a circumferential collar 6. The internal cup 5 houses a permanent magnet 7, which preferably should be the strongest permanent magnet available, for example, the type of magnets described as "supermagnets" and sold under the names or trade marks Alcomax or Alnico.

Magnet 7 is enclosed by means of a hollow cylindrical magnet housing 8 which at its bottom region contacts magnet extension 9, and at its top region contacts adjusting cap 11. The magnet 7, magnet housing 8, and magnet extension 9 are held rigidly in place against adjusting cap 11 by means of screw 10.

Mounted above adjusting cap 11 and connected to it is an adjusting handle 12. Adjusting cap 11 can be adjusted upwardly or downwardly within the distance of adjusting threads 13, which are machined within the inside surface of the upper region of internal cup 5.

Adjusting cap 11 can have calibrations on the top surface thereof indicating various positions for the cap ranging from 0 to 9. The position of the adjusting cap 11 is indicated by means of dial pin 14. A pin stop 15 is mounted at the end of dial pin 14 and, when in place, prevents anyone intending to adjust the setting of the adjusting cap 11 from deliberately or inadvertently completely screwing cap 11 out of threads 13, and thereby breaking the magnetic circuit and reducing the effectiveness of the device.

A number of O-rings 16 (eight shown in Figure 1) are positioned at various critical positions throughout the internal regions of the water conditioner 1 in order to prevent water under high pressure leaking between the interfaces of the various components making up the water conditioner 1.

A magnetic field created by magnet 7, and transmitted through magnet extension 9 passes between seat interface 17 and valve seat 18. The distance between seat interface 17 of magnet extension 9 and valve seat 18 at the bottom of cup 5 can be adjusted to provide different settings. Accordingly, the length and hence strength of the magnetic field can be adjusted within certain limits. Furthermore, since the distance between seat interface 17 and valve seat 18 can be adjusted, the rate of water flow passing through housing 2 can also be adjusted.

The construction shown has the advantage that by means of cooperating carefully machined bevelled faces, seat interface 17 can be closed completely down upon valve seat 18, thereby completely stopping the flow of water through the housing 2. Furthermore, as the rate of water flow through housing 2 is reduced by closing the gap between seat interface 17 and valve seat 18, the reduction in the gap has the effect of increasing the magnetic flux or gauss-force of the magnetic field existing between seat interface 17 and valve seat 18. This is highly advantageous because studies appear to show that for best results, higher magnetic forces should be used for reduced rates of water flow. The gap design between interface 17 and seat 18 is advantageous also because it tends to provide a Venturi-effect on the water at this location and thereby tends to keep the gap area free of foreign particles.

FIGURES 3 and 4 depict an alternative embodiment of magnetic water conditioner 1. Essentially, the components of the alternative embodiment are basically the same as those discussed above in connection with the embodiment shown in FIGURES 1 and 2. However, the design of magnetic extension 9 is different from that shown in FIGURES 1 and 2. Seat interface 19 in the alternative embodiment shown in FIGURES 3 and 4 is machined to have a horizontal planar face. Furthermore, valve seat 20 at the bottom region of cup 5 is not cupped as shown in the embodiment depicted in FIGURES 1 and 2, but is machined to have a horizontal planar face corresponding to the face of interface 19. The magnetic field, by means of this construction, passes vertically between seat interface 19 and valve seat 20. Thus, the water passing through the conditioner 1 passes through the magnetic field immediately before passing downwardly through the exit-port openings that are located at the bottom region of internal cup 5. As with the embodiments shown in FIGURES 1 and 2, the distance between seat interface 19 and valve seat 20 can be adjusted within prescribed limits, and indeed, closed completely to adjust the rate of water flow through the housing and also the intensity of the magnetic field.

Interface 17 and valve seat 18, shown in the embodiment depicted in FIGURES 1 and 2, is preferred for completely stopping the flow of water through the conditioner 1. The angled orientation of the seat interface 17 with valve seat 18 provides greater surface area and superior closing action. However, this arrangement has the effect of spreading the magnetic field over a greater area but acts to keep the magnetic gap free of foreign particles. The embodiment shown in FIGURES 3 and 4 has the advantage that the magnetic field can be highly localized between seat face 19 and valve seat 20.

Typically, in constructing the water conditioner 1 for commercial purposes, housing 2 can be constructed of brass or a plastic having a high

pressure capability as dictated by plumbing codes in effect in the area where the conditioner 1 is installed. The magnetic circuit components, internal cup 5, magnet extension 7 and adjusting cap 11 are preferably constructed of stainless steel, since these components are subject to water exposure and should be corrosion resistant. Collar 6 can be constructed of brass, steel or a strong thermostatic plastic having good dimensional stability and high pressure capabilities. The magnet housing 8 can be constructed of either brass or strong pressure and corrosion resistant plastic or steel. All O-rings 16 are constructed of a suitable elastic degradation-resistant-material such as synthetic rubber, possibly Neoprene. Screw 10, dial pin 14 and pin stop 15 can be constructed of brass. Handle 12 can be constructed of some suitable metal such as cast-aluminum, brass or steel.

It will be seen that the magnetic water-treating device described, firstly, insulates the permanent magnets housed in the unit from the water that passes through the device, thereby eliminating solid deposits and corrosion of the magnets, and, secondly, permits ready manual adjustment in order to accommodate different water flow rates, without having to disassemble the device in any way. Varying water flow rates can be encountered either in one application, or when the device is installed in various applications involving differing water pressures and water flow rates.

Moreover, in the device described, the strength and length of the magnetic field can be adjusted to suit various applications. The magnetic field can be adjusted from about 6,000 Gauss when the device is in fully open position to 12,000 Gauss when the device is almost completely closed. This feature is advantageous because a higher intensity magnetic field is preferred for slow flow rates.

A further significant advantage of the device is that manual adjustments can be made externally simply by turning an externally located handle according to calibration on the dial mounted under the handle. This eliminates the necessity of disassembling the device in order to make flow-rate adjustments. It also permits adjustments to be made quickly and frequently.

Claims

1. A magnetic water-conditioning device in which the water to be treated flows through a flow gap of adjustable width across which a magnetic field acts which is generated by a permanent magnet, characterized in that the permanent magnet (7) is surrounded by a protective sleeve (8) closed at one end by an adjusting cap (11) and at the other by a pole piece (9) to form a plug body in which the magnet is enclosed for protection against water flowing through the gap, the pole piece defines one side of the gap and the plug body is adjustably mounted in a housing (2, 5, 6) and coupled to means (11, 12) which enable the position of the pole-piece in the housing to be adjusted from outside the housing to control the gap size and thereby change simultaneously the flow rate and the strength of the magnetic field.

2. A device as claimed in claim 1 characterized in that the pole-piece (9) has a bevelled interface (17) which cooperates with a bevelled valve seal (18) to define the gap whereby a venturi-effect is created through the gap and the interface (17) can be completely closed down on the valve seat (18).

3. A device as claimed in claim 1 or 2 characterized by means (14, 15) for limiting the range of adjustment of the gap size.

4. A device as claimed in claim 3 characterized in that the adjustment is effected by rotation of the plug body, and the limiting means comprise a dial pin (14) cooperating with a pin stop (15).

5. A device as claimed in any of the preceding claims characterized in that the adjusting cap (11) is in threaded engagement (13) with the housing (5) for adjustment of the pole-piece position.

Patentansprüche

1. Vorrichtung zum magnetischen Behandeln von Wasser, bei der das zu behandelnde Wasser durch einen Strömungsspalt einstellbarer Weite strömt, über dem ein Magnetfeld wirkt, welches durch einen Permanent-Magneten erzeugt wird, dadurch gekennzeichnet, daß der Permanent-Magnet (7) von einer Schutz-Hülse (8) umgeben ist, welche an einem Ende durch eine Justier-Kappe (11) und am anderen Ende durch ein Pol-Stück (9) abgeschlossen ist, um einen Aufnahme-Körper zu bilden, in dem der Magnet zum Schutz gegen durch den Spalt strömendes Wasser eingeschlossen ist, wobei das Pol-Stück eine Seite des Spaltes bildet und der Aufnahme-Körper einstellbar in einem Gehäuse (2, 5, 6) befestigt ist und mit Einrichtungen (11, 12) verbunden ist, mittels welcher die Stellung des Pol-Stückes im Gehäuse von außen einstellbar ist, um die Größe des Spaltes zu steuern und dadurch gleichzeitig die Strömungsgeschwindigkeit und die Stärke des Magnetfeldes zu variieren.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Pol-Stück (9) eine abgeschrägte Fläche (17) aufweist, welche mit einer abgeschrägten Ventil-Dichtung (18) zusammenwirkt, um den Spalt zu bilden, wodurch ein Venturi-Effekt durch den Spalt erzeugt wird und die Fläche (17) vollständig in Schließeingriff mit der Ventil-Dichtung (18) bringbar ist.

3. Vorrichtung nach einem der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß Einrichtungen (14, 15) vorgesehen sind, um den Einstellbereich der Spaltgröße zu begrenzen.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Einstellung durch Drehung des Aufnahme-Körpers erfolgt und daß die Begrenzungseinrichtungen einen Anzeige-Stift (14) aufweisen, welcher mit einem Stift-Anschlag (15) zusammenwirkt.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Justier-Kappe (11) in Gewindeeingriff (13) mit dem Gehäuse (5) steht, um die Stellung des Pol-

Stückes justieren zu können.

Revendications

1. Dispositif à champ magnétique pour le conditionnement d'eau, dans lequel l'eau à traiter s'écoule par un intervalle d'écoulement de largeur réglable et soumis au champ magnétique produit par un aimant permanent, caractérisé par le fait que l'aimant permanent (7) est entouré par un manchon de protection (8), ledit manchon étant fermé à une extrémité par un chapeau de réglage (11) et à l'autre extrémité par une pièce polaire (9), de façon à former un bouchon renfermant l'aimant et le protégeant contre l'eau passant par l'intervalle d'écoulement, que la pièce polaire définit une face de l'intervalle, et que le bouchon est monté réglable en position dans un boîtier (2, 5, 6) et relié à des moyens (11, 12) permettant de régler de l'extérieur du boîtier la position de la pièce polaire dans ledit boîtier, de façon à contrôler la largeur de l'intervalle et pouvoir ainsi faire varier simultanément le débit de l'écoulement d'une part, et la force du champ magnétique d'autre part.

2. Dispositif selon la revendication 1, caractérisé par le fait que la pièce polaire (9) présente une face en biseau (17) qui coopère avec un siège de soupape en regard pour définir l'intervalle d'écoulement, la disposition étant telle qu'un effet Venturi soit créé et que la face (17) puisse être abaissée jusqu'au contact contre le siège de soupape (18).

3. Dispositif selon la revendication 1 ou 2, caractérisé par le fait qu'il comporte des moyens (14, 15) pour limiter la plage de réglage de la largeur de l'intervalle d'écoulement.

4. Dispositif selon la revendication 3, caractérisé par le fait que le réglage est réalisé par une rotation du bouchon, et que les moyens pour limiter la plage de réglage comprennent un ergot radial (14) coopérant avec une butée (15).

5. Dispositif selon l'une des revendications précédentes, caractérisé par le fait que le chapeau de réglage (11) est engagé par une portion filetée (13) dans le boîtier (5) pour le réglage de la position de la pièce polaire.

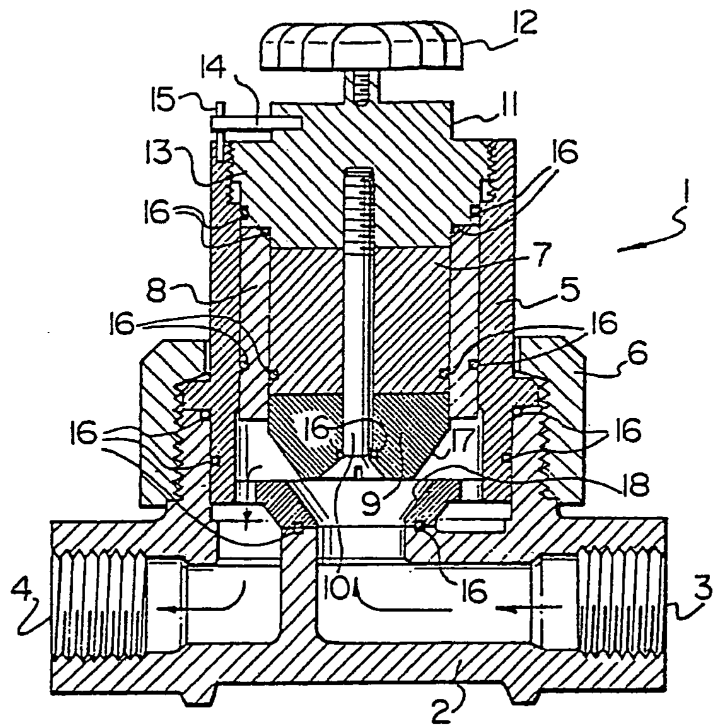

FIG. 1

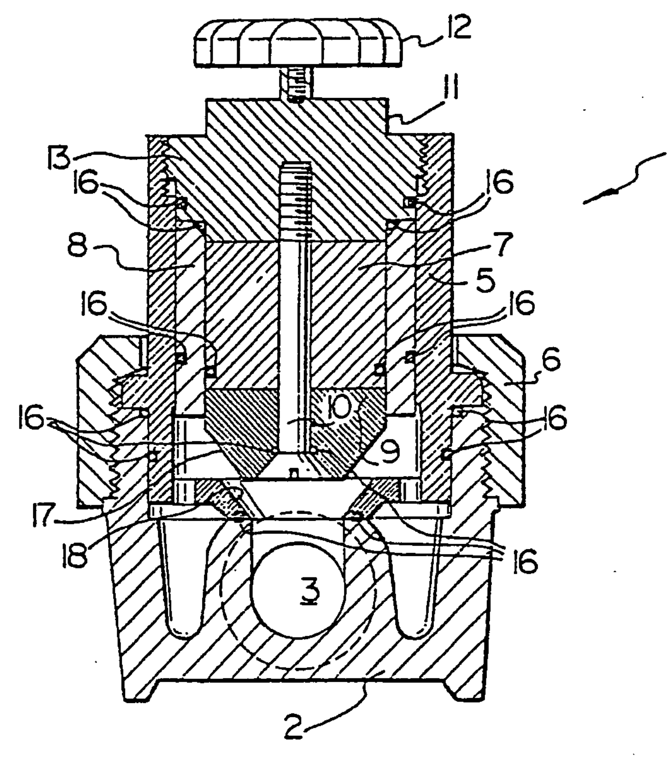

FIG. 2

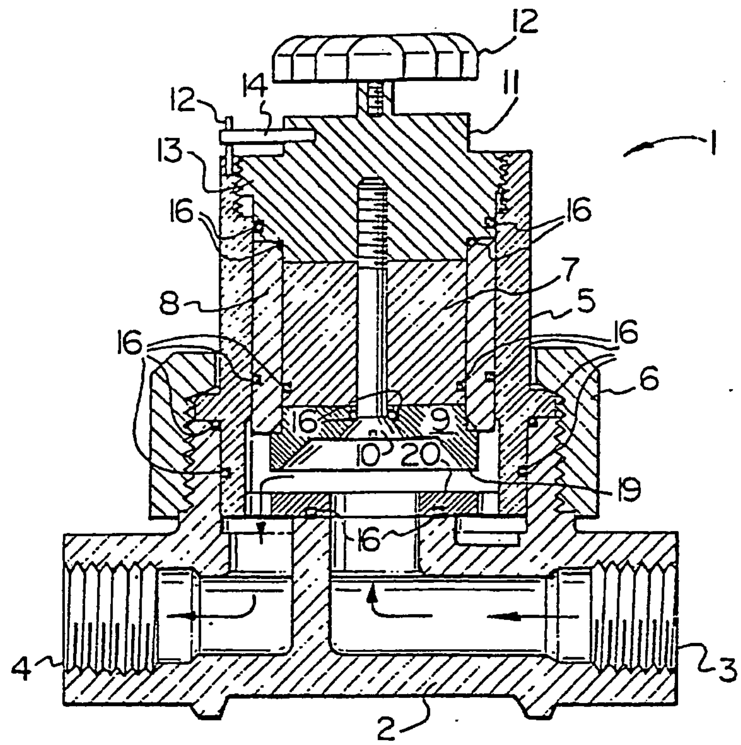

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FIG. 3

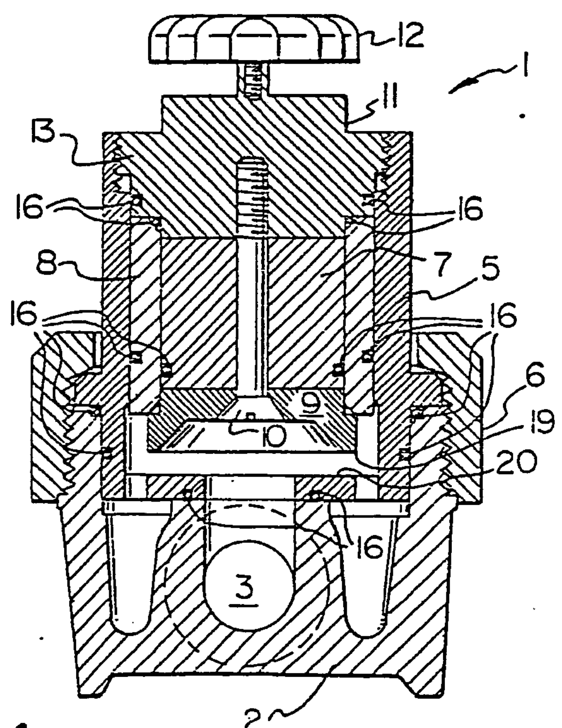

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FIG.4